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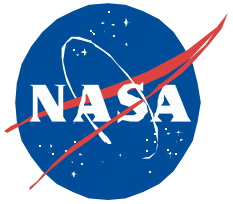

STS-109 Hubble Space Telescope Servicing Mission-3B Flight Readiness Review

Cal Seaman
EVA Project Office
Johnson Space Center

February 14, 2002

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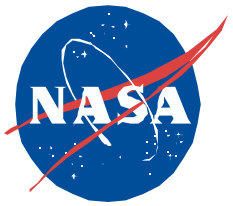
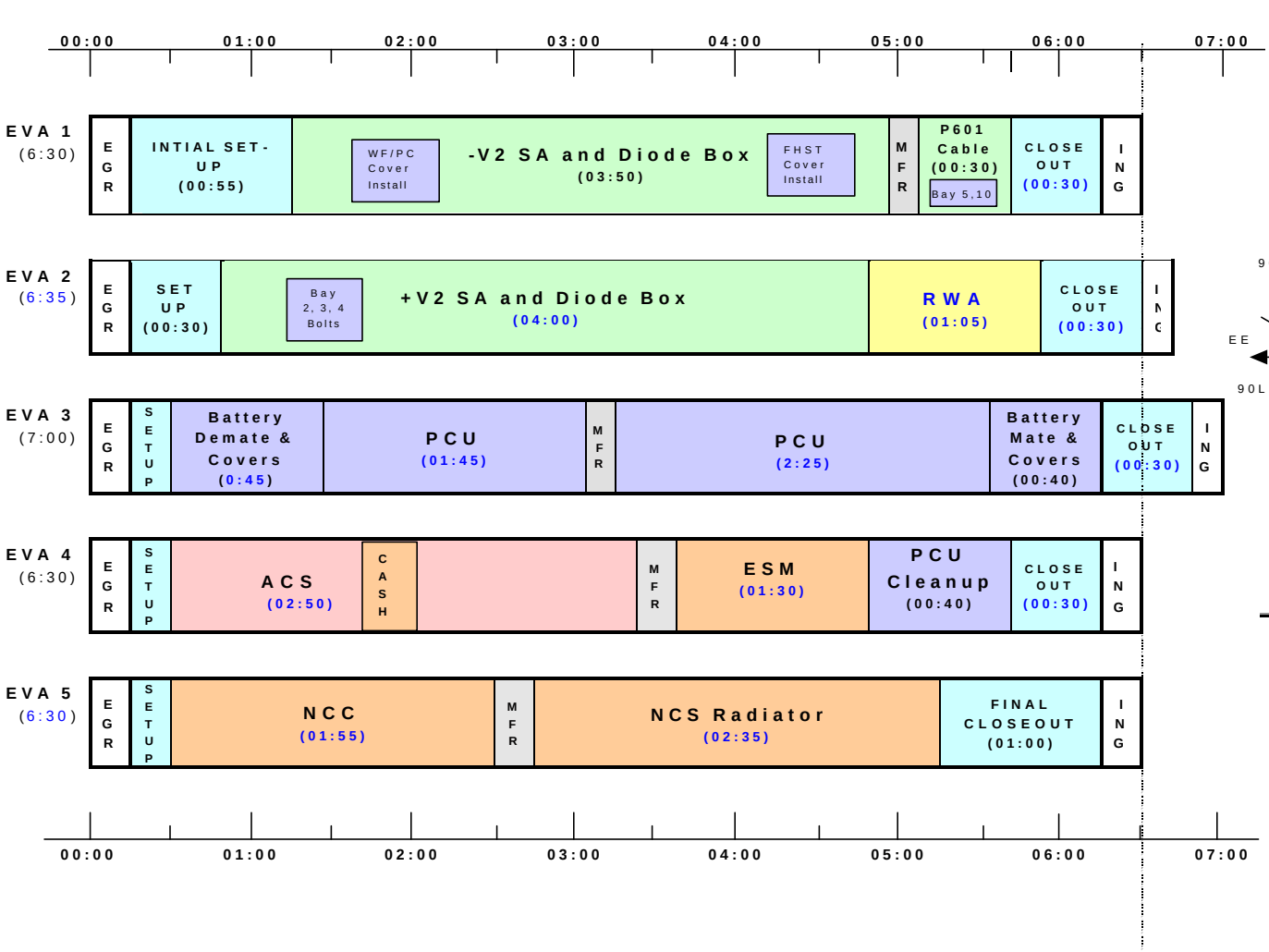
EVA Overview



- **Five Scheduled EVA's**
  - EVA 1: Remove and Replace –V2 Solar Array-2 (SA-2) and Diode Box with Solar Array 3 (SA-3)
  - EVA 2: Remove and Replace +V2 SA-2 and Diode Box with SA-3, Remove and Replace the Bay 6 Reaction Wheel Assembly #1 (RWA-1)
  - EVA 3: Remove and Replace the Power Control Unit (PCU)
  - EVA 4: Remove the Faint Object Camera (FOC) and install the Advanced Camera for Surveys (ACS)
  - EVA 5: Install the NICMOS Cooling System (NCS)
- **One Unscheduled EVA**
  - Mission success objectives
- **Two Contingency EVA's**
  - HST deploy contingencies
  - Orbiter contingencies

EVA Overview



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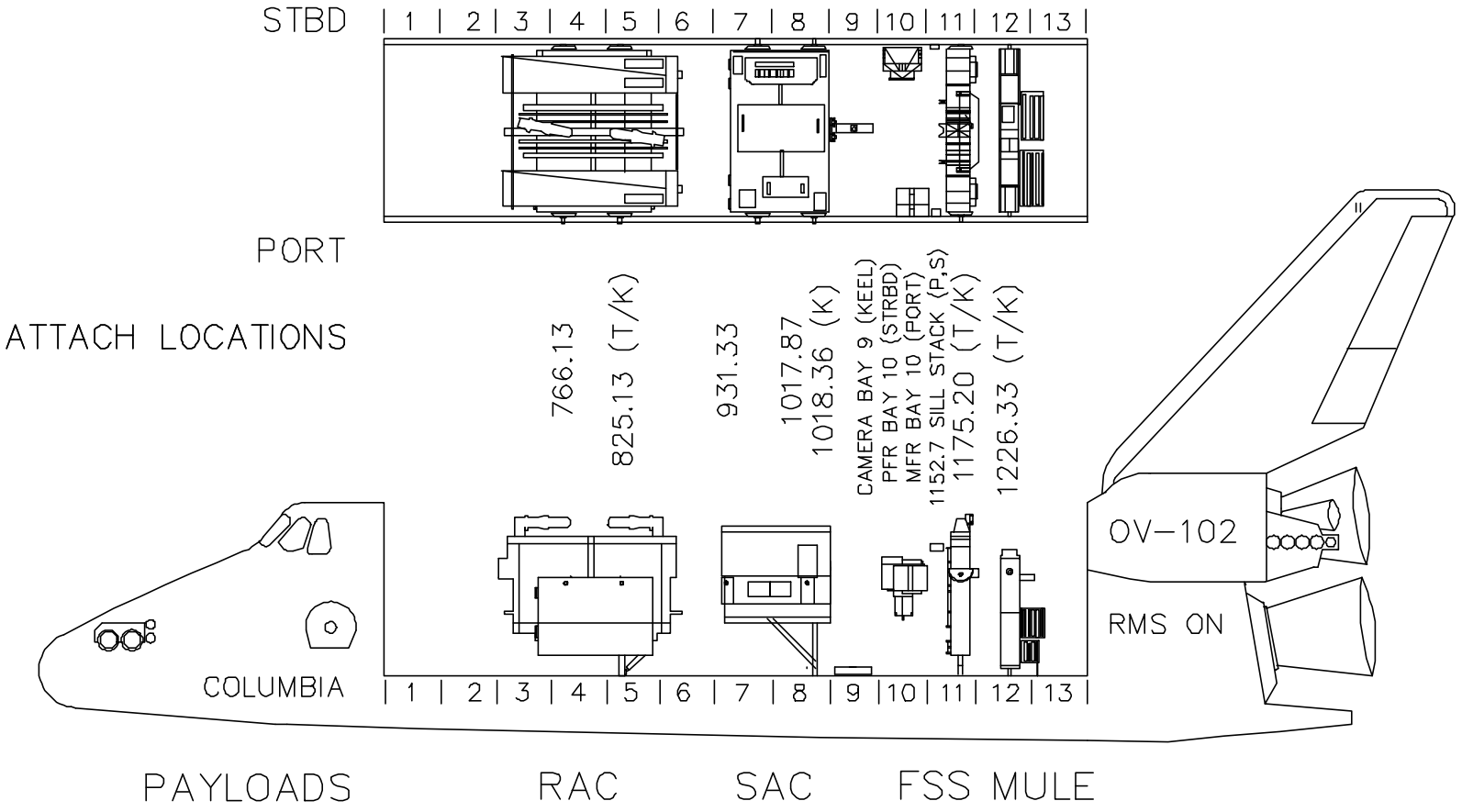
Payload Bay Configuration



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EVA Challenges

- **The STS-109 mission poses the most challenging EVA mission objectives to date**
  - EVA 1, EVA 2, and EVA 4 are within the experience base and have been managed through nominal training techniques
  - EVA 3 and EVA 5 are outside the experience base and present the most significant EVA challenges with the greatest risk of timeline growth
- **Challenges / Mitigation Plan**
  - EVA 3 (Power Control Unit)
    - The PCU has 36 connectors which are difficult to access and actuate. Most relevant experience was replacement of the Data Interface Unit on STS-82, which experienced significant timeline growth.
    - Challenge has been mitigated by additional timeline margins, the development of new tools, and higher fidelity mockups and training

EVA Challenges

- EVA 5 (NICMOS Cooling System)
  - The NCS conduit installation task is outside the EVA experience base
  - Training has been conducted using high-fidelity 1-G mockups and Neutral Buoyancy Simulations have incorporated a 20% timeline uncertainty factor

EVA Timeline Threats

- **Aft Shroud Latch Repair Kit Installation**
  - Could add 30 minutes to 1 hour to EVA 4 and EVA 5
  - Door latch torque criteria has recently been increased to reduce this risk but it still exists

- **Handrail Cover Installation**
  - If the handrails required for EVA 4 and EVA 5 exhibit flaking paint, then the covers will be installed during EVA 3
  - The cover installation task has been performed on STS-103
  - If required, the task will increase crew hand fatigue just prior to the hand-intensive PCU connector task

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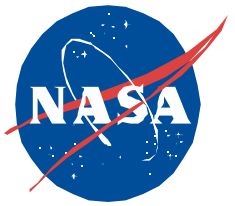
EVA Training Summary



- Nominal and contingency timeline training is complete
- EMU training is complete
- VR lab and Precision Air-Bearing Facility were used for mass handling simulations
- Each crewmember used the high-fidelity PCU trainer once per week for nominal and contingency PCU training
- Aft shroud door trainer was used every other week

EVA Hardware and Tools Summary

- **External EVA Hardware Summary**
  - Manipulator Foot Restraint (MFR) - Bay 10-Port
  - HST Portable Foot Restraints (PFR) - Bay 10-Starboard and GSFC Flight Support System
    - HST PFR and MFR latch assemblies modified with new locking handles in response to STS-103 wear issue
    - Orbiter grounding strap added to the Bay 10 assembly
  - Four STS PFR's - Two each on the Second Axial Carrier (SAC) and Rigid Array Carrier (RAC)
  - Port and Starboard Provisions Stowage Assemblies (PSA)
  - Long slidewire configuration

EVA Hardware and Tools Summary

- **EVA Support Equipment and Tools**
  - Over 300 tools manifested to support the mission
  - No major new JSC EVA hardware
  - Tool-to-Tool Fit Checks: 1150/1153 = 99.7% complete
  - Tool-to-Interface Fit Checks: 3599/3601 = 99.9% complete
  - The five open fit checks are low risk and have been accepted by the EVA Configuration Control Board

- **EMU Support Equipment**
  - Four, airlock stowed, EMU's with consumables for 8 EVA's
  - Phase-VI EMU gloves (Two sets for each EV crewmember)
  - Wireless Video System for HST closeout photography

EMU Processing

- **Ground processing requirements were updated to reflect the certified capability of the EMU and eliminate unnecessary test and inspection on the ground for EMU's still within certification limits**
- **EMU's are certified to operate on-orbit for 369 days / 25 EVA's between maintenance intervals and for 100 launch/landing cycles**
- **STS-109 is the first flight with reduced EMU ground processing**
  - One of the four EMU's on STS-109 utilized this reduced processing flow
- **Application of the certified on-orbit requirements to EMU ground processing does not introduce any new hazards or increase risk to safety or mission success**
  - A thorough review of all FMEA / CIL and Hazards was performed. Changes were considered "editorial" in nature by the SSRP
  - Utilizing this capability will result in less wear and tear on the EMU
  - All units will still perform Orbiter / EMU integrated testing (V1103.02)

Summary

- **EVA lessons learned from STS-61, STS-82, and STS-103 have been reviewed and incorporated**

- **The STS-109 mission will be a challenge, but the joint JSC/GSFC EVA team is prepared to support the flight**

Statement of Readiness

- **The EVA Project Office certifies that there are no constraints to the launch of STS-109**

Original signed by

G. Allen Flynt
Manager
EVA Project Office